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Potential of Bentonite and Resistant Wood Active Charcoal as Virgin Coconut Oil (VCO) Purity Improvements Through Bonding of Free Fatty Acid Compounds

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Abstract

Virgin Coconut Oil (VCO) is pure coconut oil produced from fresh coconuts and does not contain additional chemicals. VCO has a high lauric acid content which acts as an antibiotic, namely antiviral, antibacterial and antiprotozoal so that VCO can increase the human body's resistance to disease or viruses. Free fatty acid (FFA) levels will significantly affect the quality of VCO. The requirement for maximum fatty acid content in VCO to be suitable for consumption is 0.2%. One of the efforts to reduce the free fatty acid levels of VCO is to use adsorbents such as activated charcoal and bentonite. This study aims to determine the effect of bentonite and activated charcoal of pelawan wood (*Tristaniopsis merguensis*) enhancers of VCO purity. The results showed that the best reduction in free fatty acids was using bentonite and activated charcoal of wood-furnaced pelawan, which was 0.265, while the best turbidity test result was 0.193.

Keywords: Pelawan wood, Virgin Coconut Oil (VCO), antibacterial, FFA, coconut.

INTRODUCTION

On January 30, 2020, the coronavirus became an international concern as the WHO had declared COVID-19 a public health emergency. The increase in COVID-19 cases is quickly spreading between countries, including Indonesia (Putri, 2020). Improving community resilience through individual body health is one of the prevention efforts that can be done. The body's resistance can be maintained and increased through healthy living habits such as maintaining cleanliness good nutrition intake, which is no less important with the use of health supplements (Perpustakaan Loka Litbangkes Pangandaran, 2020)

Virgin Coconut Oil (VCO) is pure coconut oil produced from fresh coconuts, and virgin coconut oil (VCO) is not processed with high heat. Also, there is no addition of chemicals (Hapsari & Welasih, 2013). VCO has high lauric acid content, which will be converted into monolaurin in the body. VCO can act as an antibiotic monoglyceride compound, antiviral, antibacterial, and antiprotozoal. VCO can increase the human body's resistance to disease or viruses and accelerate healing (Dali, Firdaus, & Rusman, 2017). However, a common problem with VCO is that free fatty acids have exceeded the reasonable threshold, resulting in increased levels of Low-Density Lipoprotein (LDL) in the blood or what is often called bad cholesterol (Sanhia, Pangemanan, & Engka, 2015). So it is necessary to purify Virgin Coconut Oil by binding free fatty acids with activated bentonite material. Based on Tanjaya's research (2018), activated bentonite can absorb free fatty acid in used cooking oil. These free fatty acids are due to silanol groups formed from SiO_2 compounds in bentonite during acid activation (Tanjaya et al., 2018).

Activated charcoal can be obtained from various plants, including cacao shells (Sekewael, Latupeirissa, & Johannes, 2015), mahagony rind (Tanasale, Latupeirissa, & Letelay, 2014), and pelawan wood. Polii (2016) has researched refining coconut oil from smoked copra using activated charcoal and bentonite as adsorbents. Thus, bentonite with activated charcoal combined can produce a better adsorbent material. Active charcoal In this study, the activated charcoal used was from the stem of the resistance (*Tristaniopsis merguensis Griff*). The fighter has a very high total phenolic (Roanisca, Mahardika, & Sari, 2019). High phenolic compounds can come from secondary metabolites from the lignin group so that they have a good structure when used as activated charcoal.

METHODOLOGY

Materials and Instrumentals

The tools and materials used in this study were sample bottles, beakers, measuring cups, volumetric flasks, dropper pipettes, hotplates, spatulas, stirrers, portable turbidimetry, centrifuges, Shimadzu UV-VIS Spectrometers, Thermolyne furnaces, ovens, 45 and 200 sieves. mesh, burette and stative, erlenmeer, thermometer, XRD at PT Innovation Green Indonesia.

The materials used in this study were Virgin Coconut Oil, pelawan wood, bentonite, 0.1N H_2SO_4, Merck Chloroform, Aquades, 0.1 N KOH, 0.1N oxalic acid, pH paper, technical N-hexane, PP indicator, Ethanol, β-carotene.

Methods

Preparation of Virgin Coconut Oil (VCO)

The VCO obtained from the fermentation process is then centrifuged first. It aims to separate the solids from the oil to get VCO without solids.

Bentonite Activation

Five grams of washed bentonite was added with 200 mL of 0.1 N H_2SO_4. Then refluxed at 80 ^oC, and the residue was taken and baked for 3 hours at 80 ^oC. Then ground until smooth and sieved using a 200 mesh sieve.

Production and Activation of Combat Wood Activated Charcoal (*Tristaniopsis mergeunsis*)

The wood is sun-dried to dry. The next stage is the carbonization process which is processed in two methods. It is burning in a furnace and a furnace for 2 hours at a temperature of 650 ^oC to become carbon (Charcoal). The carbon obtained was ground and sieved using a 45 mesh sieve. Furthermore, the two carbon products as 10 grams were mixed with 40 mL 11% sulfuric acid (H_2SO_4) activator and then stirred for 30 minutes. After that closed and left for one day, the soaked carbon was washed using distilled water until the pH was neutral and filtered using filter paper to form an activated carbon precursor. The activated carbon precursor was then burned at 80 ^oC for 3 hours in an oven.

XRD Analysis on Bentonite and Wood Activated Charcoal *(Tristaniopsis mergeunsis)*

After activation of bentonite and wood charcoal, a fine powder was obtained. Subsequently, bentonite powder and wood charcoal were tested using X-Ray Diffraction at Greenlabs RnD, Bandung.

Characterization of Virgin Coconut Oil (VCO) before and after Purification with Bentonite Adsorbent and Pelawan Wood *(Tristaniopsis mergeunsis)* Activated charcoal

The adsorption step was carried out by heating 40 mL of VCO which had been mixed with bentonite adsorbent and 1:1) wood activated charcoal (1:1) as much as 1.5% (w/v) on a hot plate at a temperature of 100 ^oC with time variations of 30, 60, 90, 120, and 150 minutes. After cooling, the VCO was filtered through Whatman filter paper no. 41.

Free Fatty Acid (FFA) Test

Weighed 2 grams of the adsorbed VCO sample was put in a titration flask, added 10 mL of Ethanol, shaken until homogeneous, heated to boiling, cooled, and added phenolphthalein indicator (pp). The next step is titrated with 0.1 N KOH. The titration is stopped after the solution changes color to pink, lasting for 30 seconds. The FFA determined using Equation 1.

$$\% \text{ FFA} = \frac{(\text{VxN})\text{KOH x Fatty acid Mr}}{\text{sample (gram)x 1000}} \times 100\% \quad (1)$$

VCO Turbidity Test

A total of 0.5 mL of the adsorbed VCO sample was put in a 25 mL volumetric flask, and then chloroform was added to the limit mark. Then measured with a Hack Turbidimeter 2100 N. From the analysis data on the clarity of this oil can be seen the level of transparency of VCO.

VCO Beta-carotene Test

Color analysis was carried out using a Shimadzu UV-Vis Spectrophotometer UV-1800 type. From the analysis data, the amount of β-carotene content that is still present in the color of the VCO is known to be the level of purity of the VCO. As a standard, -carotene from carrot extract was used, which weighed 2.5 mg dissolved in 25 mL of chloroform (100 ppm solution). The mother liquor makes standard solutions 2, 4, 6, 8, 10, 20 ppm. Next, make a calibration graph to calculate the levels of β–carotene in the sample.

RESULTS AND DISCUSSION

XRD Testing on Bentonite and Wood Activated Charcoal *(Tristaniopsis mergeunsis)*

The results of the XRD of activated carbon of pelawan can be seen in Figure 1. Based on figure 1, two types of activated carbon diffraction show a carbon structure that tends to be amorphous, indicated by broad and weak diffraction peaks. $2\theta = 23{,}42^o$ shows

that the peaks are slightly narrowed, indicating graphite carbon. This result follows research Im et al. (2018), which obtained a diffraction pattern of activated carbon from coke with a similar pattern.

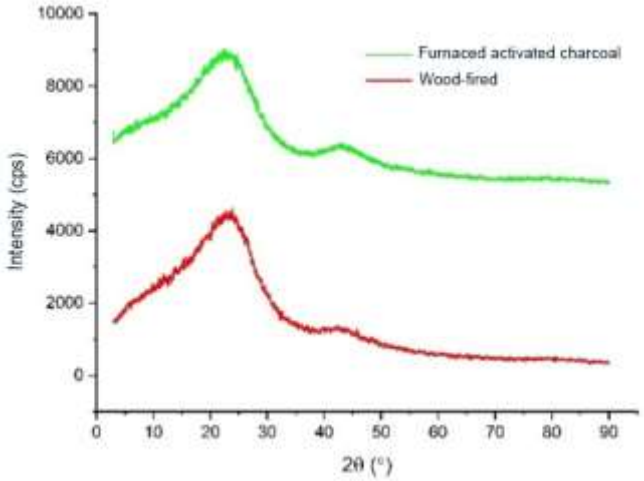

Figure 1. XRD graph of wood-fired and furnace activated charcoal

XRD analysis bentonite to determine the mineral content contained in bentonite and see the diffraction pattern at a value of 2θ and the distance between the crystalline lattice planes. The XRD diffractogram can be seen in Figure 2.

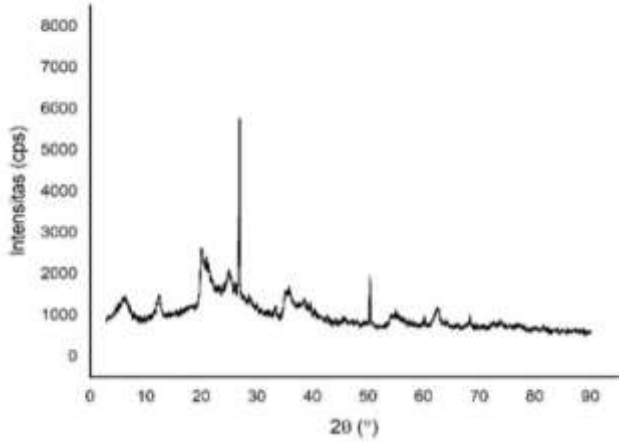

Figure 2. The XRD diffractogram

The bentonite diffraction spectrum pattern is almost similar to the diffraction pattern in natural bentonite. So, it can be said that the bentonite content is montmorillonite. The acid-activated bentonite matches the standard bentonite mineral analysis based on the XRD diffractogram. The mineral montmorillonite shows diffraction peaks at 2θ = 6.21, 20.01, and 35.43.

Free Fatty Acid Test Results

The free fatty acids (FFA) result was obtained after the VCO was adsorbed with bentonite adsorbents and activated charcoal from the wood of the opponent, are the isothermal adsorption pattern was carried out by contacting the mass of the adsorbent 1.5% (w/v) with time variables 30, 60, 90, 120, and 150 minutes with VCO at 100 °C. Then the FFA levels were calculated using equation 1. The best reduction in free fatty acids occurred at 30 minutes, where free fatty acids were obtained of 0.265 using bentonite adsorbent and activated charcoal of wood-fired opponent. This minute is considered the optimum time for adsorption because in the next minute, namely at 60 minutes, the free fatty acids obtained are more significant than before, namely 0.296. This result may be due to the saturated adsorbent, so the absorption is not optimal.

Meanwhile, the VCO purified using bentonite adsorbent and activated charcoal firewood in the table shows that the longer the stirring, the greater the free fatty acids obtained, and the free fatty acids are almost the same VCO before being purified. The results of the purification of the adsorbent bentonite and activated charcoal in the furnaced wood still meet the quality standards of SNI 7381:2008 and APPC (Asian Pacific Coconut Community) with a maximum value of 0.5% free fatty acids (Asiah et al., 2018).

Virgin Coconut Oil (VCO) turbidity test

The turbidity test results obtained after VCO was adsorbed with bentonite and wood-activated charcoal. The activated charcoal adsorbents of wood-furnace and bentonite show that 120 minutes is the optimum time for the best turbidity test results, which is 0.193. Meanwhile, the adsorbent activated charcoal burn-wood and bentonite showed that the turbidity test results obtained were very stable with all variations of stirring time.

Table 1. Result of absorption of beta-carotene VCO

Time variation (minute)	Absorbance
0	0.013
30	0.007
60	0.007
90	0.007
120	0.005
150	0.011

Beta-carotene VCO Test

Beta-carotene test results obtained after VCO adsorption with bentonite adsorbents and activated charcoal of wood resisters are shown in Table 1. Based on the results in Table 1, the longer the contact time with the adsorbent, the less beta-carotene from the VCO will be absorbed by the adsorbent of activated carbon against wood and bentonite.

CONCLUSION

Based on the study results, it can be concluded that the best reduction in free fatty acids is to use bentonite and activated charcoal of pelawan wood, which is 0.265, while the best turbidity test results are with a value of 0.193.

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